

FLORISTICS OF THE SHARK BAY WORLD HERITAGE SITE, WESTERN AUSTRALIA: VEGETATION AND FLORA OF 34 SMALL ISLANDS

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ABSTRACT

Thirty-four small islands within the Freycinet Estuary, Freycinet Reach and Disappointment Reach of the Shark Bay World Heritage area were surveyed for vegetation and flora. Only Eagle and "South West" Eagle Islands had been previously studied. All the other islands were surveyed for the first time during this survey.

Island areas ranged from <0.1 to 161 hectares. Five islands (North Smith, Briggs Rocks, two of the Wild Islets and Smith Rocks) lacked any vascular plants. Heath, shrublands and herbfields were the common vegetation formations.

A combined total of 169 species (135 native and 34 naturalised) of vascular plants were recorded. The largest families recorded were the Poaceae (22 species), Asteraceae (20 species) and Chenopodiaceae (18 species). The largest islands, Salutation, Baudin and Three Bays, supported 109, 92 and 80 species respectively. The most ubiquitous species was *Nitraria billardierei*. One species, *Calandrinia* sp. nov. (J. Alford 1376) has only been recorded from these islands.

Naturalised species were reasonably common, especially on islands mined for guano. Guano mining appears to have occurred on 15 islands (North and South Smith, Three Bays, North and South Guano, Maryanne, North and South Depuch, Freycinet, White, Charlie, North and South Kangaroo, Lefebvre and Friday) and probably on Wild-Central Islet and Double island. The vegetation has not recovered from this activity.

INTRODUCTION

Most of the islands (Salutation, Three Bays, North and South Guano, Maryanne, Freycinet, Baudin, White, Wild, Double,

Sunday, Egg, and Pelican) are part of Reserve 26004 for Conservation of Flora and Fauna and collection of Guano. Friday and Charlie Islands are separate

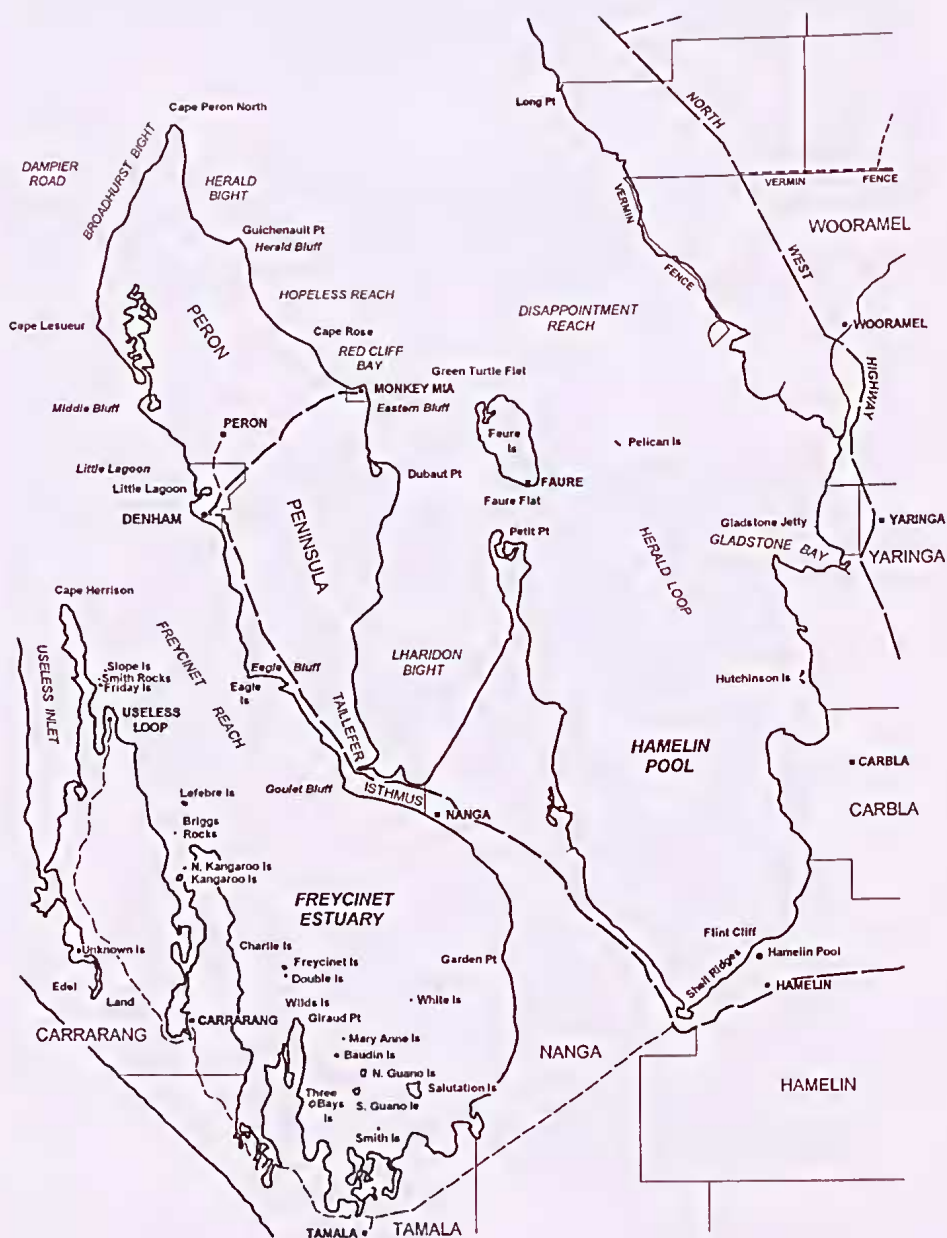


Figure 1. Location of islands surveyed, with the exception of Meade, Sunday and Egg.

reserves for the Conservation of Flora and Fauna. All of the fore mentioned islands and most of the remainder are proposed to become nature reserves, within the Shark Bay World Heritage Area.

The purpose of this report is to provide baseline data on the floristics of these islands. All the islands were visited in Spring 1989 or 1997 and surveyed where possible by foot traverse. A complete list of flora present was obtained. Structural vegetation forms were mapped, but an absence of aerial photographs meant that these were only collated as hand drawn maps, presented with a set of photographs in a report to the Australian Heritage Commission. Voucher collections are deposited in PERTH Herbarium.

Several of the islands are unnamed. In general they are named informally in this publication in relation to the nearest named island ie: NW (North-West) or SW (South-West).

A general location map of all the islands, except for Sunday, Meade and Egg (which lie just off the east shore of Dirk Hartog Island) is given in Figure 1. A total vascular flora list is presented in Table 1 with the records for each island under the numbering system listed below.

ISLAND BY ISLAND FLORA AND VEGETATION DESCRIPTIONS:

All the islands are ordered from

south to north. The number of vascular plants recorded is summarised. The area of the island is given, normally from that listed in the CALM terrestrial reserves management plan (Hancock *et al.* 2000) to high water mark. However, the area of all islands was also estimated from the CALM lands and survey coastal data set and where there was no area available these estimates are shown in parenthesis. Most of the islands have boulder slopes and beaches, which make area estimates above high water mark difficult. Vegetation communities present are summarised and a complete flora list presented in Table 1.

1. SOUTH SMITH ISLAND

26° 35' S 113° 43' E

Number of plant species recorded: 3, 0 aliens.

Area: 1.350 ha.

Vegetation:

The island consists of a rugged limestone boulder slope with guano rich pockets of sand. *Nitraria billardiarei* shrubland is the only vegetation formation present.

2. NORTH SMITH ISLAND

26° 35' S 113° 43' E

Number of plant species recorded: 0.

Area: 891m².

Vegetation:

A limestone rock- no vegetation recorded.

3. THREE BAYS ISLAND

26° 33' S 113° 39' E

Number of species recorded 80, 12 aliens.

Area: 5.2609 ha.

Vegetation:

Low sand covered island with sandy beaches, backed by grasslands of *Spinifex longifolius*, then a band of *Nitraria billardiarei* shrubs. The remainder of the island is covered with low heath of varying composition depending on depth of the sand over the limestone. Limestone outcrops have a heath dominated by *Atriplex cinerea* or *Sarcostemma viminalis*. Sandy areas have heath dominated by *Scaevola crassifolia*, with mixtures of *Nitraria billardiarei*, *Diplolaena grandiflora*, *Rhagodia latifolia* and *Carpobrotus* aff. *rossii* (Keighery & Gibson 1965).

Seabird rookeries on the northern end of the island have herbfields of *Calandrinia polyandra*, and populations of the weeds **Sisymbrium erysimoides*, **Hordeum leporinum*, **Chenopodium murale* and **Spergularia diandra*.

4. "SOUTH GUANO" ISLAND

26° 32' 46" S 113° 41' 25" E

Number of plant species recorded: 22, 3 aliens.

Area: 450 m².

Vegetation:

A small island consisting of a "plateau" with surrounding talus of rugged limestone. Shallow dark brown sandy loam with white stones, pebbles and shells over limestone. A tall shrubland of *Nitraria billardiarei* is found on the talus slopes. The plateau has

herbfields of *Calandrinia polyandra* or **Chenopodium murale* with patches of *Bromus arenarius* and emergent *Lavatera pleibea* var *tomentosa*, with a small area of very low succulent shrubland dominated by *Disphyma crassifolium*. These plateau vegetation formations result from the loss of *Nitraria* shrubland due to guano mining.

5. "NORTH GUANO" ISLAND

26° 33' 15" S 113° 41' 25" E

Number of plant species: 17, 3 aliens.

Area: 405 m².

Vegetation:

An island consisting of a central plateau, ledge like areas and steep talus slopes surrounding the plateau. The talus slopes have *Nitraria billardiarei* shrubland. Ledges have a prostrate closed succulent shrubland of *Disphyma crassifolium*. The plateau area is dominated by a grassland of *Setaria dielsii* and *Bromus arenarius* with two small areas dominated by a low succulent shrubland of *Carpobrotus* aff. *rossii* (Keighery & Gibson 1965). These plateau vegetation formations result from guano mining and were probably *Nitraria* shrubland.

6. "LITTLE GUANO" ROCK

26° 33' 15" S, 113° 41' 34" E

Number of plant species recorded: 8, 0 aliens.

Area: 405 m².

Vegetation:

Located approximately 200 metres east of North Guano

Island. This island is a rugged limestone rock with *Nitraria billardierei* shrubland to 1.5 metres. The population of the succulent herb, *Calandrinia polyandra* on this island has plants with either pink or white flowers in equal numbers.

7. SALUTATION ISLAND

26° 32' S 113° 46' E

Number of plant species recorded: 109, 14 aliens.

Area: 161.8743 ha.

Vegetation:

The largest island of the group, is covered by extensive areas of sand.

Around the island's periphery, on sandy beaches a low heath of *Calocephalus brownii* and/or *Sporobolus virginicus* grassland occurs. Behind the strand line on the primary dunes there is normally a shrubland of *Nitraria billardierei* over *Frankenia pauciflora* low shrubs or a *Sporobolus virginicus* grassland. On beaches with outcropping limestone there is a narrow band of succulent shrubland at the waters edge consisting of *Halosarcia halocnemoides* and *H. indica*. These areas are backed by a low heath of *Scaevola crassifolia* and *Frankenia pauciflora*. Limestone cliffs are covered by patchy succulent shrublands of *Disphyma crassifolium* over *Calandrinia polyandra* herbfields.

Inland the common vegetation on sandy soils is low open shrubland of *Acacia rostellifera* (occasionally replaced by *Acacia ligulata* or *A. galeata*) over *Ptilotus*

obovatus, *Rhagodia latifolia*, *Scaevola crassifolia*, *Carpobrotus aff rossii* and *Diplolaena grandiflora*. Dunes may be dominated by *Diplolaena grandiflora* or *Atriplex cinerea*.

Areas of outcropping limestone overlain by thin sands have low heaths dominated by *Atriplex cinerea*, *Scaevola crassifolia* or *Ptilotus divaricatus* over numerous shrubs, grasses and herbs. Exposed limestone has an open low succulent heath of *Sarcostemma viminale* over herbs. A seabird rookery had a mid dense herbfield of **Chenopodium murale*.

A population of the potentially serious weed Boxthorn (**Lycium ferocissimum*) was located on this island and should be eradicated. The population of *Swainsona* on this island keys to *S. longicarinata* (*Swainsona* ? *longicarinata* (J. ALFORD 1330), is the voucher collection) but is poorly placed in this species

8. BAUDIN ISLAND

26° 31' S 113° 39' E

Number of plant species recorded: 92, 9 aliens.

Area: 19.0202 hectares.

Vegetation:

A low sand covered island with several sandy beaches separated by limestone headlands, and high points of exposed limestone. Beaches have a strand vegetation of low shrubs of *Calocephalus brownii*, backed by grasslands of *Spinifex longifolius*, or sparse open shrublands of *Scaevola crassifolia* and *Nitraria billardierei*. The

remainder of the island is covered with low heath of varying composition depending on depth of the sand over the limestone. Dominants of these areas are *Scaevola crassifolia*, *Alyxia buxifolia*, *Acanthocarpus preissii*, *Diplolaena grandiflora* and *Acacia rostellifera*. Limestone outcrops have a heath dominated by *Sarcostemma viminale*. Talus slopes below limestone headlands are dominated by *Nitraria billardierei* shrubland.

9. MARYANNE ISLAND

26° 29' S 113° 41' E

Number of plant species recorded: 16, 4 aliens.

Area: 2.8328 ha.

Vegetation:

This island consists of a central plateau and surrounding talus slopes. The talus slopes are dominated by *Nitraria billardierei* very open shrubland. The plateau was mined for guano, and contains herbfields, instead of shrublands. These herbfields are dominated either by *Calandrinia polyandra*, **Sagina apetala*, **Chenopodium murale* or **Mesembryanthemum crystallinum*. Patches of *Disphyma crassifolium* succulent prostrate shrubland are found on ledges at the edge of the plateau.

WILDS ISLANDS

26° 27' 05" S, 113° 36' 53" E

These are a group of four islets, with the central and first islet joined by a tombolo.

(Total area estimated at 1.241 ha

of which the central islet is 950m².)

10. "CENTRAL" ISLAND

Number of plant species recorded: 13, 5 aliens.

Vegetation:

The central islet has a plateau surrounded by talus slopes. The vegetation of the plateau lacks any *Nitraria* shrubs but the presence of old stumps suggests that this island was mined for guano, but the slopes and ledges are also a large cormorant rookery. The talus slopes have a shrubland of *Nitraria billardierei*, with the plateau dominated by herbfields of **Chenopodium murale*, **Sagina apetala* or **Mesembryanthemum crystallinum*.

11. "FIRST ISLET"

No vegetation recorded.

12. "SECOND ISLET"

No vegetation recorded.

13. "THIRD ISLET"

Number of plant species recorded: 9, 3 aliens.

Vegetation:

A rugged limestone rock with *Nitraria billardierei* shrubs mainly on ledges with low succulent shrubland of *Disphyma crassifolium* on northern end.

14. DEPUCH ISLAND "SOUTH"

26° 26' S 113° 33' E

Number of plant species recorded: 12, 5 aliens.

Area: 479 m².

Vegetation:

Located opposite the Wilds

Islands and 400 metres from the mainland. This island consists of rounded limestone boulders and guano (? an old mined patch). Vegetation consists of one patch of *Nitraria billardiarei* shrubs, with the rest of the island having a sparse cover of a variety of scattered herbs.

15. DEPUCH ISLAND "NORTH"

26° 26' S, 113° 33' E

Number of plant species recorded: 15, 6 aliens.

Area: 0.896 ha.

Vegetation:

Located about 200 metres from the mainland. Centre of island completely bare of vegetation, a legacy of guano mining. Surrounding this area are scattered *Nitraria billardiarei* shrubs over the succulent, *Disphyma crassifolium* and grasses and herbs.

16. WHITE ISLAND

26° 27' S 113° 46' E

Number of plant species recorded: 15, 5 aliens.

Area: 4.0469 ha.

Vegetation:

Primarily limestone covered in yellowish sandy guano. The centre of the island is devoid of vegetation – a legacy of guano mining. The steep rocky slopes below the centre are covered in scattered *Nitraria billardiarei* shrubs over annuals. As the slope levels a band of *Atriplex isatidea* shrubs occurs.

Unusually this island contains two *Calandrinia* species, consisting of *Calandrinia polyandra* and a taxon that was

not able to be allocated to any named or unnamed material of the genus in PERTH. *Calandrinia* sp (J. Alford 1376) is either very rare or a poorly collected taxon.

17. DOUBLE ISLAND

26° 25' S 113° 37' E

No of plant species recorded: 13, 2 aliens.

Area: 405 m².

Vegetation:

This island consists of two high plateaus with sharp rugged limestone talus surrounding the island. Soil, where present, is a light brown to pink/orange sandy loam over massive consolidated limestone. The talus slopes have scattered shrubs of *Nitraria billardiarei* over herbs. The plateau vegetation consists of herbfields of **Chenopodium murale*, **Mesembryanthemum crystallinum* and *Calandrinia polyandra*. This vegetation type is the result of guano mining.

18. FREYCINET ISLAND

26° 24' S 113° 37' E

Number of plant species recorded: 34, 6 aliens.

Area: 3.6422 hectares.

Vegetation:

This island consists of a central plateau and surrounding talus slopes. The talus slopes are dominated by a low closed shrubland of *Nitraria billardiarei*, over half of which are damaged by guano from roosting and nesting cormorants. The plateau was mined for guano, and contains herbfields, instead of shrublands. These herbfields are

dominated by *Calandrinia polyandra* with **Chenopodium murale* and **Sagina apetala*. Patches of *Disphyma crassifolium* succulent prostrate shrubland are at the edge of the plateau. Seedlings of *Nitraria billardierei* are found throughout this area.

There is a swale in the centre of the plateau, with deeper sandy loam which has a very low, wind pruned shrubland of *Abutilon oxycarpum*, and *Ptilotus exaltatus* which contains patches of grasses and succulents. The grassland is dominated by *Bromus arenarius* to 30 cm and 1–60% cover. There is also one large patch on the talus slope below the west cliff. The succulent herbfields are dominated by *Calandrinia polyandra* (normally with pink, occasionally white flowers) varying from 10–60% cover. **Avena sterilis* is the dominant grass on a patch on the eastern dune with 60% cover.

19. CHARLIE ISLAND

26° 23' S 113° 34' E

A rock, with only scattered shrubs of *Nitraria billardierei* are present.

20. "SOUTH WEST CHARLIE"

26° 23' S 113° 34' E

Number of plant species recorded: 7, 2 aliens.

Area: 0.92 ha.

Vegetation:

A limestone rock with a thick guano enriched plateau on top. A low shrubland of *Nitraria billardierei* occurs on the edges of the plateau with a few wind

pruned specimens to 20 cm on the summit. The plateau has many old dead *Nitraria* stumps, a legacy of guano mining and cormorant colonies.

21. KANGAROO ISLAND

26° 19' S 113° 30' E

Number of plant species recorded: 11, 5 aliens.

Area: 1.177 ha.

Vegetation:

A platform island with tiny cliffs all around and shallow waters surrounding, being less than 100 metres from the mainland. Soils are very shallow grey/light brown sandy loams over ancient wave washed limestone. The margins and portions of the central dune are covered in a *Nitraria billardierei* shrubland. Where this has been removed by guano mining there is now a herbfield of **Chenopodium murale*, **Sonchus oleraceus* and **Sagina apetala* with emergent *Lavatera pleibea* var *tomentosa*.

22. NORTH KANGAROO ISLAND

26° 17' 59" S 113° 30' 11" E

Number of plant species recorded: 15, 3 aliens.

Area: 1.110 ha.

Vegetation:

A platform island with tiny cliffs all around and shallow waters surrounding, being less than 100 metres from the mainland. The margins are covered in *Nitraria billardierei* shrubland. Where this has been removed by guano mining in the centre of the island there is now a herbfield of *Calandrinia polyandra*.

23. BRIGGS ROCKS

26° 16' S 113° 29' E

No vegetation recorded.

24. LEFEBRE ISLAND

26° 14' S 113° 30' E

Number of plant species recorded: 5, 1 alien.

Island has 2 distinct limestone plateaus with a low dune between, total area: 1.985 ha.

Vegetation:

Only a few metres offshore, close to Useless Loop salt mining operations. Several hundred Pied Cormorants nest here. At the northern end there is a herbfield of **Chenopodium murale* with scattered emergent *Lavatera pleibea* var *tomentosa*. The rest of the island is mainly bare sand and guano. In places where gross disturbance has not occurred there is a fringing shrubland of *Nitraria billardiarei*.

25. "EAGLE BLUFF" ISLAND

26° 06' S 113° 35' E

Number of plant species recorded: 7, 3 aliens.

Area: 2.456 ha.

Vegetation:

This island has low cliffs and a dune on the south-eastern end. Vegetation is mainly *Nitraria billardiarei* shrubland of varying density over herbs, except for a large bare area on the dune.

Flora

Ian Abbott on 23.6.1976 recorded 8 plant species on this island (Abbott 1980). He did not record *Mesembryanthemum*, *Sagina*, *Nicotiana* or *Lavatera*. He

recorded *Pelargonium* sp (?probably *Lavatera*), *Lawrencia* sp., *Sporobolus virginicus*, *Muellerlimonium salicorniaceum*, and *Poa* sp. These five species may have become extinct on the island or may have been missed due to the fact that Bridled Terns were nesting on the island during our visit and so some parts of the island were avoided so as not to scare adults off chicks, thereby exposing them to predation.

26. "SOUTH WEST EAGLE BLUFF" ISLAND

26° 06' S 113° 35' E

Number of plant species recorded: 3, 1 alien.

Area: 495 m².

Vegetation:

We did not land on this island, however, *Nitraria billardiarei* shrubland is the dominant cover. This species and *Lavatera pleibea* var *tomentosa* were recorded from the boat. Ian Abbott recorded *Nitraria billardiarei*, **Chenopodium* sp. and *Pelargonium* sp. on his visit on 23-6-1976.

27. FRIDAY ISLAND

26° 06' S 113° 24' E

Number of plant species recorded: 5, 1 alien.

Area: 819 m².

Vegetation:

This small flat topped island, close to shore, has been severely disturbed by guano mining in the past. The southern side has a small beach with a herbfield of **Chenopodium murale* and

scattered emergent *Lavatera pleibea* var *tomentosa*. The plateau of the island lacks vegetation and consists of a mantle of guano rich sand with numerous cormorant nests. The northern end of the island is a talus slope with a low shrubland of *Nitraria billardiarei*, which probably occurred on the plateau prior to mining.

28. SLOPE ISLAND
26° 05' 47" S, 113° 24' 53" E

Number of plant species recorded: 4, 1 alien.

Area: 935 m².

This island is used as the end of the jetty for salt loading operations by Dampier Salt for their Useless Loop Operations. Most of the island surface has been destroyed or severely altered. Some remnant *Nitraria billardiarei* shrubland is found on the talus slopes of the island.

29. SMITH ROCKS

26° 05' S 113° 24' E

No vegetation recorded.

Area: 185 m².

30. "NORTH-WEST" SLOPE ISLET

26° 03' 28" S 113° 24' 51" E

Number of plant species recorded: 11, 6 aliens.

Area: 915 m².

Vegetation:

This small flat topped island, close to shore, has been severely disturbed by guano mining in the past. Some remnant *Nitraria billardiarei* shrubland is found on the talus slopes of the island.

31. SUNDAY ISLAND

26° 07' 33" S 113° 14' 07" E

Number of plant species recorded: 14, 4 aliens.

Area: 202 m².

Vegetation:

A small flat topped island, close to shore.

The plateau has a low shrubland of *Nitraria billardiarei*, which is disturbed probably from localised or exploratory guano mining.

32. MEADE ISLAND

26° 00' 06" S 113° 11' 58" E

Number of plant species recorded: 15, 5 aliens.

Area: 405 m².

Vegetation:

A small flat topped island, close to shore.

The northern end of the island is a talus slope with a low shrubland of *Nitraria billardiarei*, which probably occurred on the plateau prior to guano mining.

33. EGG ISLAND

25° 54' 35" S 113° 09' 21" E

Number of plant species recorded: 4, 2 aliens.

Area: 405 m².

Vegetation:

A small flat topped island, close to shore the island is a talus slope with a low shrubland of *Nitraria billardiarei*.

34. PELICAN ISLAND

25° 51' 13" S 114° 00' 49" E

Number of plant species recorded: 5, 1 alien.

Area: 6.0703 hectares.

Vegetation:

This low sandy island, is covered with a low shrubland of *Nitraria billardiarei*.

DISCUSSION

Heath, shrublands and herbfields were the common vegetation formations found on the islands. Species numbers ranged from 109 species recorded from the largest island, Salutation, through 92 species for Baudin and 80 on Three Bays Island (the other large diverse islands) to none recorded for 5 islands (North Smith, Briggs Rocks, two of the Wild Islets and Smith Rocks).

One hundred and sixty nine species of vascular plant were recorded during the survey from all 34 islands in the study (Table 1). These species comprised 33 Monocotyledons and 136 Dicotyledons. Thirty-four species of vascular plants were naturalised aliens, however, given the history of disturbance by guano mining and nesting seabirds, this is not surprising.

The largest families were the Poaceae (22 species – 13% of the total), Chenopodiaceae (18 – 11% of the total), Asteraceae (20 – 11% of the total) and Malvaceae (9 – 5.4% of the total). Annuals were very common comprising 69 species (most of the weeds are annuals), over 40% of the total.

The flora is of course a subset of the vascular flora of the World Heritage area, which contains ca 855 species (Trudgen and Keighery 1995). The largest

families of this flora are the Asteraceae (95 taxa – 11% of total), Poaceae (62 – 7% of the total), Myrtaceae (69 – 8% of the total), Chenopodiaceae (63 – 7% of the total) and Proteaceae (40 – 4.7% of the total). Notable differences between the proportions of the island floras compared to the adjacent mainland are in the representation of the Myrtaceae and Proteaceae which are usually poorly represented in near shore environments in Western Australia.

One species, *Calandrinia* sp. nov. (J. Alford 1376) has only been recorded from a single collection made on White Island. As with most Western Australian limestone islands off the west coast the ubiquitous species was *Nitraria billardiarei*, which was recorded from all vegetated islands. One serious weed, Boxthorn (*Lycium ferocissimum*) was recorded from Salutation Island and should be eradicated.

The small Shark Bay islands have floristic elements shared between all small offshore islands of the west coast lying north of Perth, viz: the Abrolhos (Harvey *et al.* 2001) and the Lancelin to Dongara Islands (Keighery *et al.* 2002). However, overlaying this widespread temperate element there is a significant arid element present on both the Abrolhos and the Shark Bay Islands. The flora of the islands is arid - temperate in nature, but impoverished compared to the adjacent peninsular of Edel Land or the larger Dirk Hartog Island.

Table 1. Vascular plants recorded on islands in the Freycinet Estuary

	1	2	3	4	5	6	7	8	9	10	11	12
MONOCOTYLEDONS	.											
ANTHERICACEAE												
<i>Dichopogon tyleri</i> N.H. Brittan			.									
<i>Murchisonia volubilis</i> N.H. Brittan			.					.				
<i>Thysanotus patersonii</i> R.Br.							.					
ASPHODELEACEAE												
<i>Bulbine semibarbata</i> (R.Br.) Haw.			.					.				
DASYPOGONACEAE												
<i>Acanthocarpus preissii</i> Endl.			.				.	.				
<i>A. robustus</i> A.S.George							.	.				
<i>A. sp</i> (Hopper 1367)			.					.				
<i>Lomandra maritima</i> T.S. Choo								.				
DIOSCOREACEAE												
<i>Dioscorea hastifolia</i> Endl.							.					
PHORMIACEAE												
<i>Dianella revoluta</i> R.Br.							.	.				
POACEAE												
* <i>Avena barbata</i> Link												
* <i>A. sterilis</i> L.												
<i>Bromus arenarius</i> Labill.						
<i>Bromus diandrus</i> Roth						
<i>Cymbopogon ambiguus</i> A.Camus							.	.				
<i>Danthonia caespitosa</i> Gaud.			.				.	.				
* <i>Ehrharta longiflora</i> Smith							.	.				
* <i>Eragrostis barrelieri</i> Daveau							.	.				
<i>Eragrostis dielsii</i> Pilger								.				
<i>Eulalia fulva</i> (R.Br.) Kuntze								.				
* <i>Hordeum leporinum</i> Link			.							.		
* <i>Lamarkia aurea</i> (L.) Moench							.	.				
<i>Monachather paradoxa</i> Steud.							.					
<i>Paractaenum novae-hollandiae</i> P.Beauv.								.				
<i>Paspalidium sp</i>												
* <i>Phalaris minor</i> Retz.					.							
* <i>Rostraria pumila</i> (Desf.) Tzvelev						
<i>Setaria dielsii</i> Herrm.						
<i>Spinifex longifolius</i> R.Br.			.				.	.				
<i>Sporobolus virginicus</i> (L.) Kunth			.				.	.				
<i>Stipa crinita</i> Gaud.				
<i>Selegantissima</i> Labill.			.				.	.				
<i>S.nitida</i> Summerh.												



Table 1 (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12
DICOTYLEDONS												
AIZOACEAE												
<i>Carpobrotus</i> aff. <i>rossii</i> (Keighery et Gibson 1615)			•		•		•	•				
<i>Disphyma crassifolium</i> (L.) L.Bolus			•	•	•		•		•	•		
* <i>Mesembryanthemum crystallinum</i> L.							•		•	•		
<i>Tetragonia diptera</i> F.Muell.			•	•	•		•		•			
<i>Tetragonia implexicoma</i> (Miq.) J.D.Hook.			•									
AMARANTHACEAE												
<i>Ptilotus divaricatus</i> (Gaud.) F.Muell. var <i>divaricatus</i>							•	•				
<i>P. exaltatus</i> Nees.							•	•				
<i>P. gaudichaudii</i> (Steud.) J.Black var <i>gaudichaudii</i>							•	•				
<i>P. obovatus</i> (Gaud.) F.Muell. var <i>obovatus</i>							•	•				
<i>P. villosiflorus</i> F.Muell.			•				•	•				
APOCYNACEAE												
<i>Alyxia buxifolia</i> R.Br.								•				
ASCLEPIADACEAE												
<i>Gymnema granitica</i> K.L.Wilson							•					
<i>Sarcostemma viminale</i> (L.) R.Br. ssp. <i>australe</i> (R.Br.) P.I.Forst.			•				•	•				
ASTERACEAE												
* <i>Bidens bipinnata</i> L.							•					
<i>Brachycome halophila</i> P.S. Short							•					
<i>B. iberidifolia</i> Benth.			•				•					
<i>B. latisquamea</i> F.Muell.			•				•	•				
<i>Calocephalus brownii</i> (Cass.) F.Muell.			•				•	•				
* <i>Centaurea melitensis</i> L.			•									
<i>Cephalopterum drummondii</i> A.Gray							•	•				
<i>Millotia myosotidifolia</i> (Benth.) Steetz							•					
<i>Olearia axillaris</i> (DC.) F.Muell.								•				
<i>Olearia dampieri</i> (DC.) Lander							•	•				
<i>Podolepis microcephala</i> Benth.												
<i>Podotheca angustifolia</i> (Labill.) Less.							•					
* <i>Pseudognaphalium luteo-album</i> (L.) Hilliard & B.L.Burtt.							•					
<i>Rhodanthe humboltiana</i> (Gaud.) P.G. Wils.			•				•	•				
<i>R. oppositifolium</i> (S.Moore) P.G. Wils.			•				•					
<i>Senecio lautus</i> G.Forst.			•	•			•	•				
* <i>Sonchus oleraceus</i> L.			•	•	•		•	•	•	•		
* <i>S. tenerrimus</i> L.									•	•		
* <i>Urospermum picroides</i> (L.) Scop.			•				•	•				
<i>Waitzia podolepis</i> (Gaud.) Benth.							•	•				

Table 1 (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12
BRASSICACEAE												
* <i>Brassica tournefortii</i> Gouan												
* <i>Hymenobolus procumbens</i> (L.) Nutt. ex Shinz.				.								
<i>Lepidium linifolium</i> (Desv.) Steud.												
<i>L. puberulum</i> Bunge												
<i>L. rotundum</i> (Desv.) DC.								.				
* <i>Sisymbrium erysimoides</i> Desf.				.				.				
<i>Stenopetalum pedicellare</i> F. Muell. ex Benth.							
CAESALPINIACEAE												
<i>Senna glutinosa</i> (DC.) Randall ssp. <i>chatelainiana</i> (Gaud.) Randall				.				.				
CAPPARACEAE												
<i>Capparis spinosa</i> L. var <i>nummularia</i> (F.Muell.) Bailey				.				.	.			
CARYOPHYLLACEAE												
* <i>Cerastium glomeratum</i> Thuill.				.								
* <i>Polycarpon tetraphyllum</i> (L.) L.									.			
* <i>Sagina apetala</i> Ard.										.	.	
* <i>Silene gallica</i> L.				.					.			
* <i>Silene nocturna</i> (Moench.) Garke								.				
* <i>Spergularia diandra</i> Heldr et Sart.				.				.				
CHENOPODIACEAE												
<i>Atriplex cinerea</i> Poir.		
<i>A. bunburyana</i> F.Muell.									.			
<i>A. isatidea</i> Moq.					
* <i>Chenopodium album</i> L.												
<i>C. gaudichaudianum</i> (Moq.) P.G. Wils.						
* <i>C. murale</i> L.				
<i>Dysphania plantaginella</i> F.Muell.									.			
<i>Dysphania sphaerosperma</i> P.G. Wils.				.								
<i>Enclylaena tomentosa</i> R.Br.					
<i>Halosarcia halocnemoides</i> (Nees) P.G. Wils. ssp <i>tenuis</i> P.G. Wils.								.				
<i>H. indica</i> (Willd.) P.G. Wils. ssp. <i>bidens</i> (Nees) P.G. Wils.								.				
<i>Rhagodia latifolia</i> (Benth.) P.G. Wils.								.	.			
<i>R. preissii</i> Moq.					.							
<i>Salsola tragus</i> L.					
<i>Sclerolaena diacantha</i> (Nees) Benth.									.			
<i>S. uniflora</i> R.Br.				.				.	.			
<i>Suaeda australis</i> (R.Br.) Moq.				.								
<i>Throlekeldia diffusa</i> R.Br.					

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
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Table 1 (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12
CHLOANTHACEAE												
<i>Dicrastylis maritima</i> Rye & Trudgen							•					
CONVOLVULACEAE												
<i>Convolvulus erubescens</i> Sims			•									
* <i>Cuscuta epithymum</i> (L.) L.								•				
<i>Wilsonia humilis</i> R.Br.							•					
CRASSULACEAE												
<i>Crassula colorata</i> (Nees) Ostenf. var <i>colorata</i>			•	•	•		•	•				
CUNONIACEAE												
<i>Aphanopetalum clematideum</i> (J. Drumm. ex Harv.) Domin			•				•					
EUPHORBIACEAE												
<i>Euphorbia boophthona</i> C.A. Gardn.			•				•	•				
<i>E. drummondii</i> Boiss.			•				•	•				
FRANKENIACEAE												
<i>Frankenia pauciflora</i> DC.			•				•	•				
GERANIACEAE												
<i>Erodium cygnorum</i> Nees							•					
* <i>Erodium cicutarium</i> (L.) L'Her.			•									
GOODENIACEAE												
<i>Goodenia berardiana</i> (Gaud.) Carolin								•				
<i>Scaevola crassifolia</i> Labill.			•				•	•				
<i>S. spinescens</i> R.Br.							•	•				
<i>S. tomentosa</i> Gaud.							•	•				
LAURACEAE												
<i>Cassytha aurea</i> J.Z. Weber			•									
LOBELIACEAE												
<i>Lobelia heterophylla</i> Labill.							•	•				
MALVACEAE												
<i>Abutilon geranioides</i> (DC.) Benth.							•					
<i>A. oxycarpum</i> (F.Muell.) F.Muell.			•	•								
<i>Hibiscus sturtii</i> Hook. var truncatus Fryxell							•					
* <i>Lavatera cretica</i> L.			•									
<i>L. pleibeia</i> Sims var <i>tomentosa</i> Hook.f.			•	•	•	•	•		•	•		
<i>Lawencia densiflora</i> (E.G.Baker) Melville							•	•				
<i>L. viridigrisea</i> N.S.Lander		•					•	•				
<i>Sida calyxhymenia</i> Gay ex DC.			•				•					
<i>S. corrugata</i> Lindl.			•				•	•				

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

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Table 1 (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12
MIMOSACEAE												
<i>Acacia galeata</i> Maslin							.					
<i>A. ligulata</i> Cunn. ex Benth.							.	.				
<i>A. rostellifera</i> Benth.							.	.				
<i>A. victoriae</i> Benth.												
MYOPORACEAE												
<i>Eremophila glabra</i> (R.Br.) Ostenf.							.	.				
<i>E. maitlandii</i> F.Muell. ex Benth.								.				
<i>Myoporum desertii</i> Cunn. ex Benth.			.				.	.				
<i>M. insulare</i> R.Br.								.				
MYRTACEAE												
<i>Thryptomene baeckeacea</i> F.Muell.							.					
<i>T. sp</i> "Carrarang" (J.Alford 1350)								.				
NYCTAGINACEAE												
<i>Commicarpus australis</i> Meikle			.				.					
OLEACEAE												
<i>Jasminum calcareum</i> F.Muell.							.	.				
OXALIDACEAE												
<i>Oxalis perennans</i> Haw.			.				.					
PAPILIONACEAE												
<i>Glycine canescens</i> F.J.Herm.			.				.					
<i>G. tabacina</i> (Labill.) Benth.								.				
<i>Indigofera georgei</i> E. Pritzl							.	.				
<i>Lotus cruentus</i> Court			.				.	.				
* <i>Melilotis indica</i> (L.) All.							.					
<i>Swainsona longicarinata</i> J. Thomp.			.				.					
<i>Templetonia retusa</i> (Vent.) R.Br.								.				
PITTOSPORACEAE												
<i>Pittosporum phylliraeoides</i> DC.			.				.	.				
var <i>phylliraeoides</i>												
PLANTAGINACEAE												
<i>Plantago drummondii</i> Decne.								.				
PLUMBAGINACEAE												
<i>Muellerlimon salicorniaceum</i>			.					.				
(F.Muell.) Lincz.												
PORTULACCACEAE												
<i>Calandrinia polyandra</i> Benth.	
<i>C. sp</i> (J. Alford 1376)												
<i>Portulacca oleracea</i> L.							.					

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Table 1 (cont.)

	1	2	3	4	5	6	7	8	9	10	11	12
PRIMULACEAE												
<i>Samolus repens</i> (Forst. et Forst.G.)			.					.				
Pers.ssp nov. (J.Alford 1251)												
PROTEACEAE												
<i>Grevillea candelabroides</i> C.A.Gardn.			.									
RANNUNCULACEAE												
<i>Clematis linearifolia</i> Steudel								.				
RUTACEAE												
<i>Diplolaena grandiflora</i> Desf.			.					.	.			
SANTALACEAE												
<i>Exocarpus aphyllus</i> R.Br.			.					.	.			
<i>Santalum</i> ? <i>lanceolatum</i> R.Br.									.			
SAPINDACEAE												
<i>Alectryon oleifolius</i> (Desf.) S.T.			.					.	.			
Reynolds ssp. <i>oleifolius</i>												
<i>Dodonaea viscosa</i> Jacq. ssp.								.				
<i>angustissima</i> (DC.) J.G. West												
SOLANACEAE												
* <i>Lycium ferocissimum</i> Miers								.				
<i>Nicotiana occidentalis</i> Wheeler ssp.		
<i>hesperis</i> (N.T. Burb.) Horton												
* <i>Solanum nigrum</i> L.												
SURIANACEAE												
<i>Stylobasium spathulatum</i> Desf.								.				
THYMELAEACEAE												
<i>Pimelea gilgiana</i> E.Pritzel			.					.				
<i>Pimelea microcephala</i> R.Br.								.				
URTICACEAE												
<i>Parietaria debilis</i> G.Forst.				
ZYGOPHYLLACEAE												
<i>Nitraria billardierei</i> DC.
<i>Zygophyllum apiculatum</i> F.Muell.								.				
<i>Z. fruticulosum</i> DC.		

Guano mining appears to have occurred on 15 islands (North and South Smith, Three Bays, North and South Guano, Maryanne, North and South

Depuch, Freycinet, White, Charlie, North and South Kangaroo, Lefebre and Friday) and probably on Wild-Central Islet and Double Island. Gauno

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
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mining commenced on the islands rapidly after settlement in the 1840's, but was poorly documented or regulated. In most of these islands the original

vegetation of *Nitraria* shrubland was cut down and the loose limestone rock placed in piles to facilitate collection of the guano (Wells 1955). This physical

evidence is still present on most of these islands. The plateau vegetation of the mined areas is now a herbfield, sometimes with *Nitraria* seedlings present, but on no island has the vegetation fully recovered from this activity.

ACKNOWLEDGEMENTS

Andrew Burbidge and Phil Fuller collected plants from Egg, Sunday, Meade and Pelican Islands during their seabird surveys of these islands. Their assistance made it possible to complete surveying all the small offshore islands of Shark Bay. Keith Morris and Robert Bromilow of the CALM Wildlife Research Centre assisted in accessing the islands during the survey.

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